课程大纲
COURSE SYLLABUS

1.	课程名称(中英文) **Course Title(Chinese and English)**	应用量子力学 **Applied Quantum Mechanics**
2.	**课程类别 Course Type**	专业核心课
3.	授课院系 **Originating Department**	Materials Science and Engineering
4.	可选课学生所属院系 **Open to Which Majors**	材料科学与工程系
4.	**课程学时 Credit Hours**	3/48
5.	**课程学分 Credit Value**	3
6.	授课语言 **Teaching Language**	中英文
7.	**授课教师 Instructor(s)**	李贵新
8.	先修课程、其它学习要求 **Pre-requisites or Other Academic Requirements**	General Physics

9.	**教学目标 Course Objectives**
	Quantum mechanics are essential to materials science and engineering at the atomic, molecular and crystal scales. Important optical, electrical, and magnetic properties of materials can only be well understood within the realm of quantum mechanics. This course is an introductory course for quantum mechanics with emphasis on applications in materials science. The objective is to provide students in materials science and engineering with basic concepts in quantum mechanics and apply the principles and methodologies to understand materials properties and device applications. Topics to be covered include Schrödinger's wave equation, Dirac notations, quantum harmonic oscillators, and perturbation theory. By applying those quantum mechanical concepts, electron propagation, optical transitions and so on are explained in detail. After completing this course, students will have in-depth understanding of important materials properties and build a solid foundation to explore frontier materials research.

10.	教学方法及授课创新点 **Teaching Methods and Innovations**
	The course combines lectures and discussions for effective learning. During classroom lectures, core concepts will be recapitulated to help students learn the topics. The knowledge points will be further clarified by answering and discussing student questions. To help establish the ability of applying the knowledge, numerous examples regarding to important material and device applications are illustrated by applying the concepts and theories of quantum mechanics. This approach is believed to help students develop an in-depth understanding of the course content. A final project will provide another opportunity to the students to develop knowledge mining and knowledge application skills to address a current research topic related to quantum mechanics. The project will also help students collaborate and work in a team environment. The term paper and project presentation will help students develop and hone their written and oral communication skills. This course is partially taught in English, including lectures, discussions, homework, exams, term papers and presentations.
11.	教学内容及学时分配 **Course Contents and Course Schedule**
	Week 1-2: Review of classical mechanics - Concepts of potential and kinetic energy, conservation of energy in a closed system, one dimensional harmonic oscillator, Linear atomic chain; Week 3-4: Review of classical electromagnetism - electrostatics and electrodynamics, Maxwell's equations, light propagation in dielectric media, power and momentum of electromagnetic wave; Week 5-7: Toward quantum mechanics - Quantum behaviour and blackbody radiation, hydrogen atom, wave-particle duality, uncertainty principle and the fluctuation characteristics of electrons; Week 8-9: Schrödinger equation - Wave function and Schrödinger equation, quantum operators, state space and Dirac's notations; Week 10-12: Angular momentum – Spin angular momentum and Pauli matrixes, spin singlet and triplet states of electron, movement of charged particles in an electromagnetic field; Week 13-14: Two-level system - Two-level system in an electronic field and in a magnetic field; Week 15-16: Quantum properties of photons – Polarization of photons, the spin and angular momentum of photons and statistics of photons;
12.	课程考核 **Course Assessment**
	Homework: 20% **Midterm**: 25% **Final exam**: 35% **Project and presentation**: 20%
13.	教务安排 **Course Logistics**

TA:

Office hour: Friday Morning

14. **教材及其他参考资料 Textbook and Supplementary Readings**

Textbook:

Applied Quantum Mechanics, Author: A. F. J. Levi, Publisher: Cambridge University Press 2nd ed. 2012, ISBN: 0521183995